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Librarians are at the center of the automation success story as patrons and administrations become more at ease with information technology. Cover by Anja Wregbo-Welling

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"By the end of the century, however, librarians, even though they surely will not have discarded bibliography and its associated printed materials, will be well out 'beyond bibliography' "

EIDOS and the Transformation of Libraries

By Frederick G. Kilgour

THE PREMISE of this paper is that time and technology have conjoined to make desirable and possible the evolution of libraries beyond their 19th Century foundation in bibliography into institutions providing information per se.

After reviewing the arena in which the evolution has already begun, a major initial advance in direct information provision, the Electronic Information Delivery Online System (EIDOS) will be described. Finally, the challenge to librarians and the exciting prospects for librarianship at the advent of the 21st Century will be sketched.

The arena

The Information Society of the present had its origins in the middle decade of the 19th Century, when increasing speeds in processing and distributing energy and materials necessitated production and processing of huge amounts of information to control these activities.[1] For example, early railroad systems required large amounts of dynamic information to attain efficient use of equipment and track and to prevent disastrous train wrecks.

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The need for such information has increased explosively. Compare the small amount of information required to operate the horse-drawn stages of a century-and-a-half ago and the huge quantity needed to keep the jet aircraft of a modern airline on an efficient schedule. Indeed, without computers—mainframe, mini, and micro—to collect, store, and process the necessary information, the modern airline could not operate at all, and the same can be said for many activities that did not even exist prior to World War II.

The demand for information and information itself are both accruing at such increasing rates that human minds and the serial-processing computers of the 1980s cannot handle the flood. Fortunately, artificial intelligence is beginning to come to the rescue, particularly in the form of expert systems to cope with huge masses of information dynamically accumulating in medicine, chemistry, manufacturing, publishing, and even librarianship.[2]

The Information Age is not likely to recede. Table 1 reveals that with the exception of only one decade, namely 1860–70, there has been a steady increase in the percentage of the civilian labor force involved in the information sector of the economy from 1800 to 1980. In the latter year it reached 46.6 percent, higher than ever attained by the industrial and service sectors and not reached by agriculture since 1870. Since 1960, the information sector percentage has exceeded each of the other three.

Libraries losing the struggle

It has been apparent for some time that libraries are in failure. First, because the titles that patrons need have not been acquired; second, because materials that have been acquired are unavailable on the shelf 40 percent of the time; third, when a requested item is available, it may not contain the information the user is seeking; and fourth, reference librarians answer questions correctly only half the time.

In 1986, John Mansbridge published a review article[3] in which he examined more than 40 availability studies that had been carried out in libraries from 1934 to the early 1980s. The early studies concentrated on failures such as those due to a book being on loan, lost, awaiting reshelving, and on the shelf in its proper place but not found.

Mansbridge brought together 21 studies carried out from the late 1960s to early 1980s that produced an average failure rate of 38.8 percent. Mansbridge also assembled studies of the Kantor type by nine authors that yielded an average failure rate of 40.6 percent.

In 1976, Paul B. Kantor published his classic article, "Availability Analysis,"[4] that classified failure into four major groups: 1) the library had not acquired the book; 2) the book was on loan or in use in the building; 3) failures due to library procedures and library error; and 4) user error due to failure to locate an entry

in the catalog and to locate a book on the shelf when it was in its proper position. Subsequently, the fourth group was divided into two groups: user error at the catalog and user error at the shelf. Establishment of these five categories has greatly increased the usefulness of failure studies.

Three studies have analyzed failure rates in relation to a loan period. In 1937 the author did a study of shelf availability at the Harvard College Library in connecton with the design of edge-notched punch cards for a circulation record that was installed in June 1938 and was the first of its kind. The study yielded a 43 percent failure rate associated with a loan period of one month and also showed that if the loan period were decreased to two weeks then failure rate would drop to 29 percent.

One year after the first study and five months after the installation of a new two-week loan period, the failure rate was 28 percent. During the six months following installation, the volume of circulation was 24.5 percent greater than for the same six months in 1937.[5]

Michael Buckland studied failure rates at the University of Lancaster (England) where the loan period was for the full academic term. Reducing nine percent of the collection to a one-week loan period caused circulation to increase over 100 percent. It continued to increase annually during the next two years at 11.4 and 8.7 percent.[6]

The third study was based on data collected at the Sears Library of Case Western Reserve University in 1972 when a semester loan policy was in effect, and in 1974 when the loan period was four weeks. In 1972 the failure rate in terms of "satisfaction level" was 52 percent and in 1974, 44 percent, a 15 percent decrease in failure rate due to the shortening of the loan period.[7]

As already mentioned, even when a requested book is available, it may not contain the information sought. The author recently experienced three failures of this sort. Seeking information to be included in a paper, he obtained on interlibrary loan three currently published books whose titles gave strong indication that the books would contain what he wanted. Two of them contained nothing, and the third only a single sentence, that was useful. Nevertheless, the title accurately described the books; they were not frauds.

The studies previously referred to did not explore users' success in obtaining desired information. They only investigated the availability of

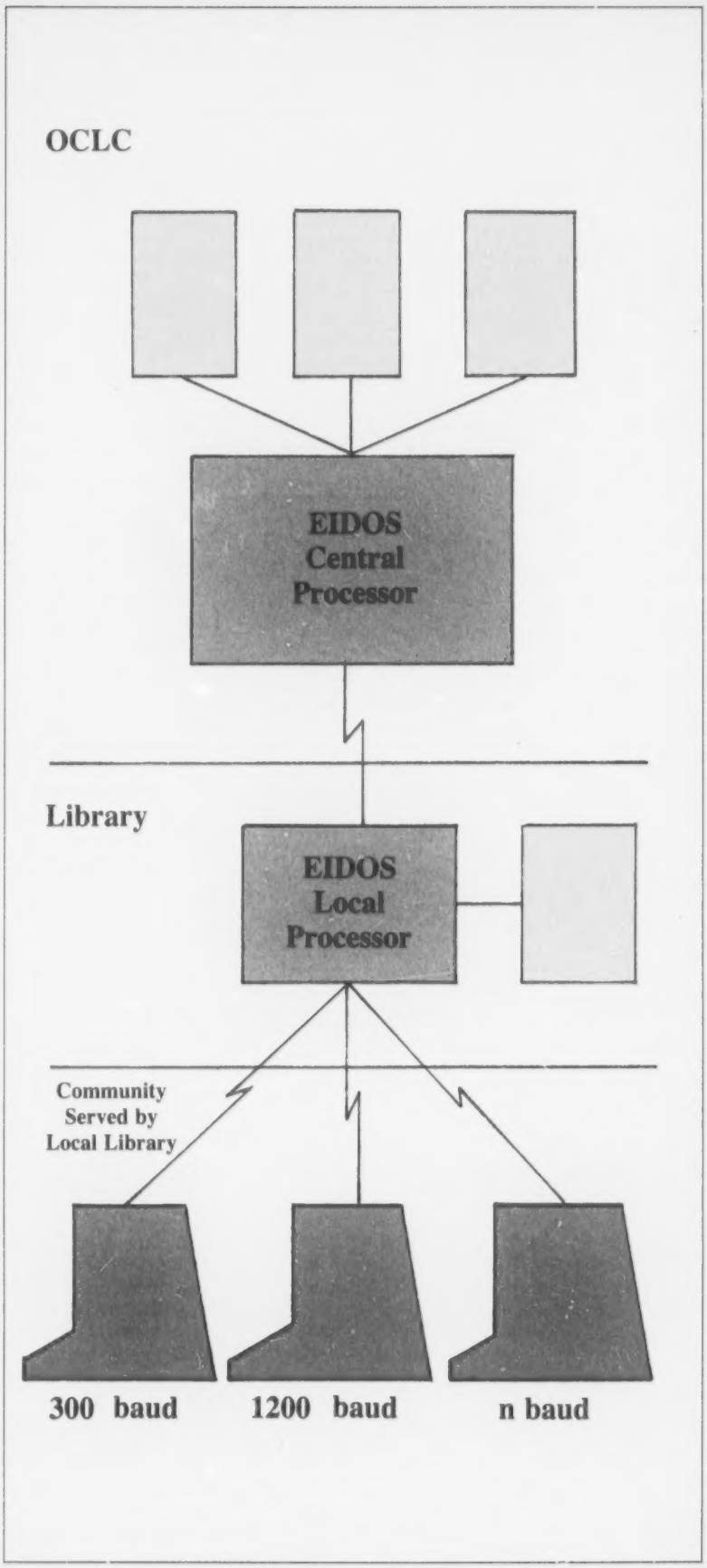

Table 1

U.S. experienced civilian labor force by four sectors, 1800–1980 (from *The Control Revolution: Technological and Economic Origins of the Information Society* by James R. Beniger, courtesy of Harvard Univ. Pr.)

Year	Sector's Percent of Total: Agricultural	Industrial	Service	Information	Total labor force (in millions)
1800	87.2	1.4	11.3	0.2	1.5
1810	81.0	6.5	12.2	0.3	2.2
1820	73.0	16.0	10.7	0.4	3.0
1830	69.7	17.6	12.2	0.4	3.7
1840	58.8	24.4	12.7	4.1	5.2
1850	49.5	33.8	12.5	4.2	7.4
1860	40.6	37.0	16.6	5.8	8.3
1870	47.0	32.0	16.2	4.8	12.5
1880	43.7	25.2	24.6	6.5	17.4
1890	37.2	28.1	22.3	12.4	22.8
1900	35.3	26.8	25.1	12.8	29.2
1910	31.1	36.3	17.7	14.9	39.8
1920	32.5	32.0	17.8	17.7	45.3
1930	20.4	35.3	19.8	24.5	51.1
1940	15.4	37.2	22.5	24.9	53.6
1950	11.9	38.3	19.0	30.8	57.8
1960	6.0	34.8	17.2	42.0	67.8
1970	3.1	28.6	21.9	46.4	80.1
1980	2.1	22.5	28.8	46.6	95.8

Sources: Data for 1800–1850 are estimated from Lebergott (1964) with missing data interpolated from Fabricant (1949); data for 1860–1970 are taken directly from Porat (1977); data for 1980 are based on U.S. Bureau of Labor Statistics projections (Bell, 1979, p. 185)

bibliographic units—books, journals, etc. To be sure, reference librarians attempt to answer questions both bibliographic and informational, but they fail to satisfy patrons' needs half the time, leading to the formulation of the so-called "55 Percent Rule."[8]

The skyrocketing demand for information will push library users further and further into discouragement, and because of increasing numbers of nonusers there will be decreasing effective financial support. The bibliographical base of traditional librarianship was not designed to respond to an age clamoring for information.

The demand now is for information per se, not for packages that might contain something useful. An example is the experience of the Public Library of Columbus and Franklin County (Ohio), which in 1975 handled 318,082 reference questions of which a third came in by telephone. Ten years later in 1985, it handled 916,857, of which three-quarters came in by telephone.

In other words, the number of questions put to the reference department in person remained essentially the same while there was nearly a 600 percent increase in telephoned requests.

EIDOS: direct info to users

Conceived by the author in 1983 and currently in development by OCLC, EIDOS purports to be one of the first major innovations designed to enable libraries to move out beyond bibliography by furnishing users directly with information. Figure 1 depicts the system's architecture. Its prototype was first exhibited in London in December 1984 at the 8th International Online Meeting, where the first paper was also presented.[9] A pilot model of EIDOS will be available in 1988.

Operating electronically on computers over telecommunication circuits and accessed from various types of equipment used as terminals, EIDOS will supply comprehensive data, information, and knowledge to information seekers of all sorts in homes, offices, schools, colleges, universities, and libraries. Sources of information, in electronic form, will comprise books, journal articles, government documents, reports, selected numeric databases, and maps and charts.

OCLC anticipates the book databases will be available to libraries in 1989 and maps and charts in 1992. Other sources not now generally available such as lectures and TV and radio programs will follow. Only books in machine-readable form, supplied by publishers as by-products of electronic publishing, will be included in the first phase.

A dozen publishers have expressed interest in collaborating, and half of them have furnished EIDOS with books in machine-readable form. For purely arbitrary reasons, fiction and reference books will be excluded from the pilot model.

The purpose of EIDOS is to promote the welfare and effectiveness of people by making information increasingly available. Its goals are to provide immediate availability of information in electronic form to every user at any time; to increase the scope and quantity of available information; and to improve the user satisfaction/cost ratio of information delivery.

EIDOS is coming into being at this time primarily because of the arrival on the scene in the early 1980s of the ubiquitous microcomputer, which is now the instrument of choice for producing half the book manuscripts written in this country and is widely used by editors as well.

Sales of microcomputers with

telecommunication capabilities have also rocketed upward. Such micros comprise the major type of terminal equipment that will be accessing data, information, and knowledge from EIDOS.

Information users possessing micros with modems will be able to access a local EIDOS system in a local library over local telephone circuits. Access will also be possible from terminals within libraries.

To locate a desired book the user can search the local library database by author, author/title, title, and subject, then obtain on their micro monitor either the table of contents or the back-of-the-book index for the page location of desired information.

A request by the page number will retrieve the page for display from the full text which will be housed in machine-readable form in a large optical memory located at OCLC. It is important to note that the page is always "on the shelf" and that scores of information seekers can be using it at the same time.

EIDOS will benefit users, libraries, and publishers. Users will benefit from greatly increased success rates in obtaining needed information with less personal expenditure in time and money. Similarly, EIDOS will benefit libraries by greatly improving their success rates in supplying information to users and thereby increasing user satisfaction and a more supportive attitude toward libraries. Further benefits for libraries will be reduced expenditures for processing and shelving books. Publishers will enjoy increased revenues coupled with decreased costs.

Prospects for the century's end

The fifth-generation computer systems that will comprise the second computer revolution will also generate the first library revolution. By the mid-1990s, EIDOS will almost certainly be processing every traditional form of library materials with the use of artificial intelligence techniques, and will have begun to process such nontraditional and presently unavailable sources as TV and radio programs, lectures, committee hearings, and the like. It is inconceivable that such nontraditional sources could be processed by humans, for the burden would make such processing uneconomically labor intensive.

The major components of EIDOS and the major components of the fifth-generation computer systems are strikingly analogous but are in no way equivalent.[10] Fifth-generation computer systems will operate almost entirely on a base of artificial intelligence whereas EIDOS at the present time contains none. Nevertheless, EIDOS as it is being developed will be able to use artificial intelligence techniques in the foreseeable future, probably in the form of expert systems and intelligent user interfaces. The avenues from EIDOS to fifth-generation computer systems will be tortuous to say the least, but when the goal of the fifth-generation computer is reached, EIDOS will be an enormously powerful information system.

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Hitherto libraries have been inflexible arrangements of catalog entries and materials on shelves and have been as passive as their materials. Library literature characteristically speaks of "users" or "readers," but not about specific individuals. The only bibliographic or informational experience a user has is at the reference desk, although it appears that no more than five percent of people entering a library consult reference personnel.

By the end of the century, however, librarians, even though they surely will not have discarded bibliography and its associated printed materials, will be well out "beyond bibliography," and the focus of their professional concern will be to treat each user as an individual even to the extent of supplying them with information before they seek it.

All seekers of information will then enjoy the service now rendered by the one-librarian library, where the librarian knows the users individually and knows the information contents of the collection. To travel from the large, passive, monolithic libraries of today to the active library of the future will require imagination and hard work. Tremendous new areas of unknown will open up that will cry for research investigation and production of new knowledge.

With the aid of artificial intelligence techniques such as expert systems, librarians will have to create dynamic collections of information, and librarians' activities will be ever-increasingly intellectual. There can be no doubt that the exciting new librarianship ahead will bring with it great pleasure and satisfaction.

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